EH Resident Competency 2.18

Competency 2.18 **EH Residents shall demonstrate the ability to evaluate hazardous energy control programs in accordance with the following regulation and Department of Energy (DOE) Order:**

- **29 CFR 1910.147, Hazardous Energy Control**
- **DOE Order 5480.19, Conduct of Operations Requirements for DOE Facilities**

1. Supporting Knowledge and Skills

a. Using the appropriate standard(s), identify the markings and guards required for a specific piece of electrical equipment.

b. Describe the requirements and verify that the contractor's lockout/tagout program adequately addresses the following areas:
   - Use of lockout/tagout
   - Adequacy of procedures
   - Verification of lockout/tagout
   - Reenergizing equipment
   - Protection from shock/equipment start
   - Surveillance of the lockout/tagout program
   - Initial and annual training requirements

c. Verify the specialized personal protective equipment and adequacy of worker qualifications for an activity involving hazardous energy.

d. Identify one type of each of the following hazardous energy sources at your site:
   - Electrical
   - Mechanical
   - Pneumatic
   - Hydraulic
   - Thermal
   - Chemical
   - Radiation

e. Given a hazardous energy source, describe the lockout/tagout requirements.

f. Differentiate between the lockout/tagout requirements for the following:
   - Personnel protection
   - Equipment protection
   - Operations
   - Administrative
   - Confined space

g. Define independent verification and discuss when independent verification is required.

h. Given a lockout/tagout for a hazardous energy source, verify that the lockout/tagout adequately isolates the hazardous energy source.

2. Self-Study Activities (corresponding to the intent of the above competency)

Below are two web sites containing many of the references you may need.

Web Sites		
Organization	**Site Location**	**Notes**
Department of Energy	http://wastenot.inel.gov/cted/stdguido.html	DOE Standards, Guides, and Orders
OSHA	http://www.osha-slc.gov/	OSHA documents and search engine
U.S. House of Representatives	http://law.house.gov/cfr.htm	Searchable Code of Federal Regulations

Read 29 CFR 1910.147, "The Control of Hazardous Energy (Lockout/Tagout);" DOE-STD-1030-92, *Guide to Good Practices for Lockouts and Tagouts*, sections 4.2 and 4.4; and DOE Order 5480.19, Attachment 1, chapter IX, Lockouts and Tagouts

EXERCISE 2.18-A Use the process matrix provided below to identify the markings and guards (i.e., the lockout/tagouts) required for a motor control center (MCC).

NOTE: The actions and steps listed in the matrix should work for any electrical equipment. Apply it to other devices as appropriate.

Application of Control for a Motor Control Center (MCC)			
Action		**Steps**	**Specific Markings and Guards (Lockouts/Tagouts) for MCC**
1	Preparation for shutdown	• Identify the type and magnitude of the energy • Identify the hazards of the energy to be controlled • Identify the method or means to control the energy	Energy type: Magnitude: Energy hazards: Control methods or means:
2	Machine or equipment shutdown	List the turn off or shut down procedures established for the machine or equipment	Shutdown procedures:
3	Machine or equipment isolation	• Physically locate all energy isolating devices that are needed to control the energy to the machine or equipment • operate so as to isolate the machine or equipment from the energy source(es)	Location of energy isolating devices: Isolation operating procedure:
4	Lockout or tagout device application	Affix lockout or tagout device to each energy isolating device	Lockout used: Tagout used:
5	Stored energy	Render safe all potentially hazardous stored or residual energy by relieving, disconnecting, restraining, or other method	Method for rendering safe all stored or residual energy:
6	Verification of isolation	Prior to starting work on locked out/tagged out machines or equipment, verify that isolation and deenergization of the machine or equipment	Isolation and deenergization indicators:

Scan DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Attachment I.

EXERCISE 2.18-B Complete the following table, citing the DOE Order 5480.19 requirements and references for the following.

Contractor Lockout/Tagout Requirements		
Title	**Required**	**DOE Order 5480.19 Reference**
Use of lockout/tagout		
Adequacy of procedures		
Verification		
Reenergizing equipment		
Protection-shock/equipment start		
Surveillance		
Initial/Annual Training Requirement		

For the following exercise, refer to facility-specific/local procedures and 29 CFR 1910 as needed.

EXERCISE 2.18-C Verify the specialized personal protective equipment (PPE) and adequacy of worker qualifications for an activity involving hazardous energy at your facility.

Example:

Activity	**Specialized PPE**	**Worker Qualifications**
Work inside a 220 V distribution box	Insulated tools, goggles, rubber gloves, rubber mat	Only a worker trained in those procedures (or a worker in training and under the direct supervision of a qualified worker) may work on power-on equipment.

EXERCISE 2.18-D Using the table below, identify one type of each of the following hazardous energy sources that apply to your site.

Hazardous Energy Sources		
Hazardous Energy	**Example**	**Location**
Electrical	Distribution box	Room 271-4A west wall
Electrical		
Mechanical		
Pneumatic		
Hydraulic		
Thermal		
Chemical		
Radiation		

EXERCISE 2.18-E Given a hazardous energy source at your site(s), describe the lockout/tagout requirements.

The answer is site-specific and dependent on the equipment selected. However, for a particular hazardous energy source, the following checklist can be used to verify what is required for the lockout/tagout program/procedures.

Lockout/Tagout Requirements			
Title	**Required**	**Contractor Program Checklist**	
		Yes	**No**
Use of lockout/tagout	Locks and tags should be placed on controls when for safety or other administrative reasons controls must be established.		

Lockout/Tagout Requirements			
Title	**Required**	**Contractor Program Checklist**	
		Yes	**No**
Adequacy of procedures	Procedures should be developed, documented, validated, and utilized for hazardous energy or material.		
Verification	Personnel should verify that isolation and deenergization has been accomplished.		
Reenergizing equipment	Before energy is restored, procedures followed and actions taken.		
Protection-shock/equipment start	All personnel positioned or safely removed from the area.		
Surveillance	Periodic inspections should be conducted by authorized personnel.		
Initial/Annual Training Requirement.	Training should be provided and documented.		

NOTE: The checklist is based on the requirements of DOE Order 5480.19 and 29 CFR 1910.147.

EXERCISE 2.18-F To differentiate between the following terms, complete the table below.

Lockout/Tagout Terminology	
Term	**Definition**
Personnel protection	
Equipment protection	
Operations	
Administrative	
Confined space	

Read DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, Attachment 1, Chapter X, "Independent Verification."

EXERCISE 2.18-G Define independent verification.

EXERCISE 2.18-H Discuss when independent verification is required

Read 29 CFR 1910.147, *Hazardous Energy Control*, (3) "Purpose."

Given the following scenario, determine the steps needed to verify that the lockout/tagout effectively isolates the energy source.

EXERCISE 2.18-I Scenario: An overhead light socket has burned out due to dust, condensation, and/or age. The light is turned off/on by a wall switch. A repairman is coming in to replace the socket. Assuming that a lockout/tagout program is in place, where must the lockout/tagout device be placed to effectively isolate the socket from the energy source and what additional checks should be made to verify that the isolation is effective?

3. Summary

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, and 29 CFR 1910.147 set the general requirements for lockout/tagout programs and procedures and the requirements for training all personnel. The actual requirements will vary depending upon the specific site or facility, the types of equipment in a particular facility, and the hazardous energy sources.

A lockout/tagout program is used to ensure that equipment is not inadvertently started when it is not intended to start and to ensure that any stored energy does not injure personnel. Lockouts and tagouts must be strictly adhered to in order for the system or program to be effective. Ignoring a lockout/tagout can injure not only the person that ignores it but other personnel and equipment.

The training requirements state that the employer shall provide training to ensure that the purpose and function of the energy control program is understood by all employees and that the knowledge and skills required for safe application, usage, and removal of the energy controls are acquired by employees. Each affected employee shall be instructed in the purpose and use of the energy control procedure and all other employees whose work operations are or may be in an area where energy control procedures may be utilized, shall be instructed about the procedure and the prohibition relating to attempts to restart or reenergize machines or equipment that are locked out or tagged out.

4. Exercise Solutions

EXERCISE 2.18-A Use the process matrix provided below to identify the markings and guards (i.e., the lockout/tagouts) required for a motor control center (MCC).

ANSWER 2.18-A NOTE: The actions and steps listed in the matrix should work for any electrical equipment. Apply it to other devices as appropriate.

Application of Control for a Motor Control Center (MCC)			
Action		**Steps**	**Specific Markings and Guards (Lockouts/Tagouts) for MCC**
1	Preparation for shutdown	• Identify the type and magnitude of the energy • Identify the hazards of the energy to be controlled • Identify the method or means to control the energy	Energy type: *electric* Magnitude: *600 v* Energy hazards: *electrocution resulting in severe injury or death* Control methods or means: *Physical locking device (i.e. padlock, plastic tie, slidelock, and tag).* *Specific device should be identified by procedure.*
2	Machine or equipment shutdown	List the turn off or shut down procedures established for the machine or equipment	Shutdown procedures: *Local control switches should be tagged in a position corresponding to the desired protective state, even when the MCC or another device (e.g. circuit breaker, disconnect switch) provides the primary isolation from the energy source*
3	Machine or equipment isolation	• Physically locate all energy isolating devices that are needed to control the energy to the machine or equipment • operate so as to isolate the machine or equipment from the energy source(es)	Location of energy isolating devices: *Verify through controlled system schematics, or other controlled documents* Isolation operating procedure: *Verify proper locking and/or tagging of each control device*
4	Lockout or tagout device application	Affix lockout or tagout device to each energy isolating device	Lockout used: *Locking breaker* *Physical isolation* Tagout used: *Tags used for personnel protection and/or equipment protection*

Application of Control for a Motor Control Center (MCC)			
Action		**Steps**	**Specific Markings and Guards (Lockouts/Tagouts) for MCC**
5	Stored energy	Render safe all potentially hazardous stored or residual energy by relieving, disconnecting, restraining, or other method	Method for rendering safe all stored or residual energy: *Locking and tagging procedures should be used to identify and isolate stored energy sources. High energy sources or complex isolation should be accomplished with written procedures.*
6	Verification of isolation	Prior to starting work on locked out/tagged out machines or equipment, verify that isolation and deenergization of the machine or equipment	Isolation and deenergization indicators: • *Physical walkdown by qualified person to verify that isolation is achieved* • *Verification by measuring with a volt meter*

EXERCISE 2.18-B Complete the following table, citing the DOE Order 5480.19 requirements and references for the following.

ANSWER 2.18-B

Contractor Lockout/Tagout Requirements		
Title	**Required**	**DOE Order 5480.19 Reference**
Use of lockout/tagout	Locks and tags should be placed on controls when for safety or other administrative reasons controls must be established.	Chap. IX, Section C.1. Lockout/Tagout Use
Adequacy of procedures	Procedures should be developed, documented, validated, and utilized for hazardous energy or material.	Chap. IX, Section C.5., Procedures

Contractor Lockout/Tagout Requirements		
Title	**Required**	**DOE Order 5480.19 Reference**
Verification	Personnel should verify that isolation and deenergization has been accomplished.	Chap. IX, Section C.6.f., Verification
Reenergizing equipment	Before energy is restored, procedures followed, and actions taken.	Chap. IX, Section C.6.g., Release from lockout/tagout
Protection-shock/equipment start	All personnel positioned or safely removed from the area.	Chap. IX, Section C.6.g.(2), Personnel
Surveillance	Periodic inspections should be conducted by authorized personnel.	Chap. IX, Section C.8., Inspections
Initial/Annual Training Requirement	Training should be provided and documented.	Chap. IX, Section C.10., Training and Communication

EXERCISE 2.18-C Verify the specialized personal protective equipment (PPE) and adequacy of worker qualifications for an activity involving hazardous energy at your facility.

ANSWER 2.18-C The answer is site-specific. Please refer to a local subject matter expert to verify your answers.

EXERCISE 2.18-D Using the table below, identify one type of each of the following hazardous energy sources at your site.

ANSWER 2.18-D The answer is site-specific. Please refer to a local subject matter expert to verify your answers.

EXERCISE 2.18-E Given a hazardous energy source at your site(s), describe the lockout/tagout requirements.

ANSWER 2.18-E The answer is site-specific and dependent on the equipment selected. However, for a particular hazardous energy source, the checklist provided in the exercise can be used to verify what is required for the lockout/tagout program/procedures.

EXERCISE 2.18-F To differentiate between the following terms, complete the table below.

ANSWER 2.18-F

Lockout/Tagout Terminology	
Term	**Definition**
Personnel protection	Lockouts to protect persons working on or around the equipment (i.e., supply voltage to electric equipment).
Equipment protection	Lockouts to protect equipment because a portion of that equipment is not useable (i.e., cooling system for an engine).
Operations	Normal production operations are not covered unless an employee is required to bypass a guard or safety device or to place part if his/her body into an area where work is actually performed or where an associated danger zone exists. 29 CFR 1910.147, (2) “Application.
Administrative	Lockouts of one of an identical set of equipment to equalize "run" times.
Confined space	Lockout used in a confined space to prevent equipment operation when hazardous conditions exist (i.e., flammable gas present).

EXERCISE 2.18-G Define independent verification.

ANSWER 2.18-G Independent verification is the act of checking that a given operation conforms to established criteria, as well as checking a component position independently of activities related to establishing the component's position.

EXERCISE 2.18-H Discuss when independent verification is required.

ANSWER 2.18-H Components that are critical to ensure safe and reliable operation should receive an independent verification of their position when circumstances warrant. The components should be identified explicitly in facility procedures or other official documents so that necessary interpretation of requirements will be minimized.

EXERCISE 2.18-I Scenario: An overhead light socket has burned out due to dust, condensation, and/or age. The light is turned off/on by a wall switch. A repairman is coming in to replace the socket. Assuming that a lockout/tagout program is in place, where must the lockout/tagout device be placed to effectively isolate the socket from the energy source and what additional checks should be made to verify that the isolation is effective.

ANSWER 2.18-I The wall switch should be placed in the OFF position and the circuit breaker in the distribution panel should be turned OFF and locked/tagged out and voltage checks (using a voltmeter) should be made at the socket and the wall switch to verify that zero volts (ø v.) is present.